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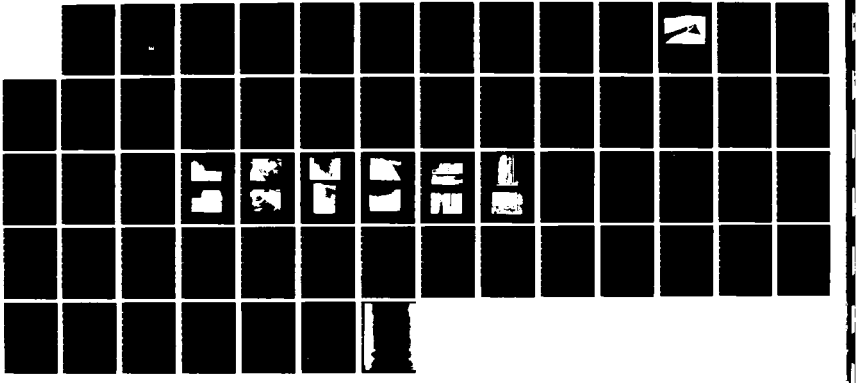

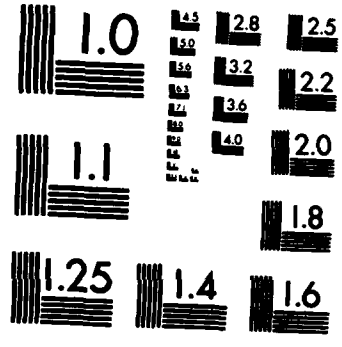

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

CONNECTICUT WESTERN COASTAL AREA

FAIRFIELD , CONNECTICUT

HEMLOCKS RESERVOIR DAM

CT 00018

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

AUGUST 1978

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

SEP 28 1978

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

I am forwarding to you a copy of the Hemlocks Reservoir Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner. The Bridgeport Hydraulic Company, 835 Main Street, Bridgeport, Connecticut 06604.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

HEMLOCKS RESERVOIR DAM

CT 00018

CONNECTICUT WESTERN COASTAL AREA

FAIRFIELD, CONNECTICUT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam: HEMLOCK RESERVOIR DAM

State Located: Connecticut

County Located: Fairfield County

Stream: Cricker Brook

Date of Inspection: 21 JUNE 1978

BRIEF ASSESSMENT

The Hemlock Reservoir Dam is a linear concrete gravity dam about 700 feet long with an earth embankment concrete cone section comprising the west side of the dam. A concrete spillway section about 120 feet long is located at the eastern side of the dam. The dam is 64 feet high. Based on the visual inspection of the site, review of available information and the past performance of the dam, the dam is judged to be in good condition.

The project will not pass the test flood without overtopping the dam, and therefore the spillway capacity is inadequate. As the spillway will pass more than 50 per cent of the test flood without overtopping, the spillway is not judged seriously inadequate. The overflow will be 0.9 feet above the top of the dam.

Horizontal and vertical cracks should be repaired to every extent possible to prevent seepage and continuing deterioration. Additionally, since the degree and extent of spalling is somewhat excessive, the areas affected should be repaired. Due to the potential for overtopping, it is recommended that a definite plan for around the clock surveillance be implemented by the owner during periods of unusually heavy rains and a formal warning system should be developed.

S. Giavara, P.E.
Principal

Registered, CT 7634

This Phase I Inspection Report on Hemlocks Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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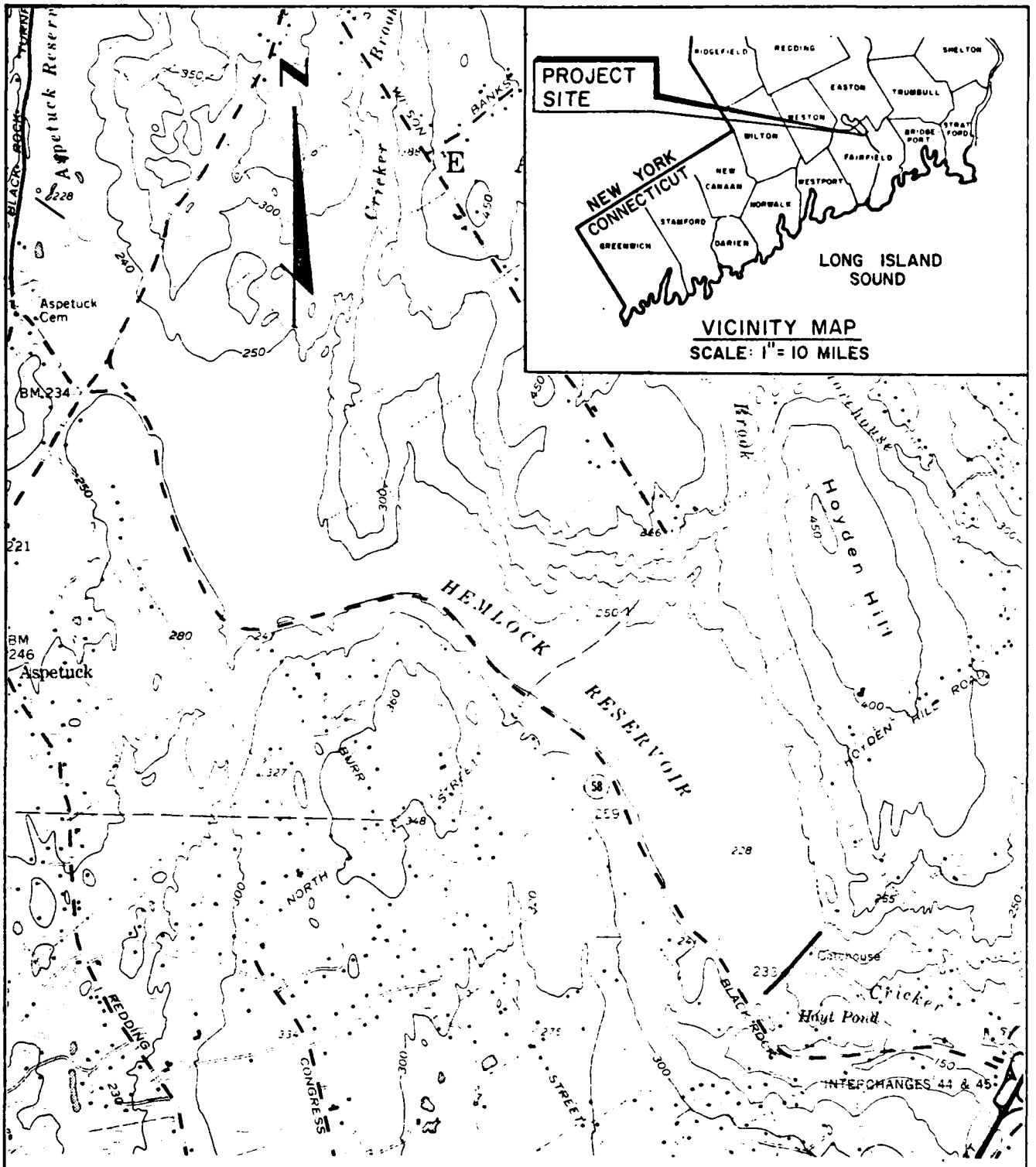
LIST OF APPENDICES

HEMLOCKS RESERVOIR DAM



LOCATION MAP

HEMLOCK RESERVOIR DAM
FAIRFIELD, CONNECTICUT

PHASE I INSPECTION REPORT
HEMLOCKS RESERVOIR DAM CT 00018

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL:

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Flaherty Giavara Associates, P.C. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Flaherty Giavara Associates, P.C. under a letter of 25 April 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-0309 has been assigned by the Corps of Engineers for this work.

b. Purpose:

1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

2) Encourage and assist the States to initiate quickly effective dam safety programs for non-federal dams.

3) To update, verify and complete the National Inventory of Dams.

1.2 DESCRIPTION OF PROJECT:

a. Description of Dam and Appurtenance. The Hemlock Reservoir Dam is a linear concrete gravity dam about 700 feet long, with an earth embankment, concrete core segment 300 feet long on the west side. A concrete spillway section is on the east side of the dam and is 120 feet in length. The spillway has an ogee crest. The dam section is 64 feet high, with a vertical upstream face and a downstream slope of 0.7 horizontal to 1 vertical. The earth embankment section has a slope of 2 horizontal to 1 vertical with a shelf and then a flatter slope to the entrance roadway. Upper and Lower gate houses provide for take off to two 48-inch supply mains and 10 and 36-inch blow off lines.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00018	2. GOVT ACCESSION NO. AD-A142 986	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Conn. Western Coastal Area, Fairfeild Conn. Hemlocks Reservoir Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE August 1978 13. NUMBER OF PAGES 55
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Western Coastal Area, Fairfeild Conn., Hemlocks Reservoir Dam

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Hemlock Reservoir Dam is a linear concrete gravity dam about 700 ft. long with an earth embankment concrete cone section comprising the west side of the dam. A concrete spillway section about 120 ft. long is located at the eastern side of the dam. The dam is 64 ft. high. Based on the visual inspection of the site, review of available information & the past performance of the dam, the dam is judged to be in fair good condition.

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b. Location. The dam is located on Cricker Brook 1.5 miles north of its junction with the Mill River within the Connecticut western coastal area. The dam is located in the Town of Fairfield, 1/2 mile north of the Merritt Parkway and 4-1/2 miles north of Mill Plain.

c. Size Classification. The applicable guidelines indicate that for an intermediate category the storage in acre/feet for the impoundment must be greater or equal to 1,000 and less than 50,000. The height must be greater or equal to 40 feet and less than 100 feet. The top of dam storage is 11,635 arce-feet and the height of dam is 75 feet. Therefore, based on both the storage capacity and height of dam the size classification is intermediate.

d. Hazard Classification. The dam is designated as having a high hazard potential. There are more than 50 dwellings less than 10 feet above the riverbed along the first 3 miles of the downstream river channel. The Merritt Parkway would also be damaged by a flood produced by a dam failure.

e. Ownership. Hemlock's Dam is owned and operated by the Bridgeport Hydraulic Company, of Bridgeport, Connecticut.

f. Purpose of Dam. The dam's function is to impound water for the Hemlock Reservoir. This reservoir forms part of the water company's distribution system and supplies a major portion of the demand.

g. Design and Construction History. The dam was designed and constructed in 1914. Both the designer and contractor who constructed the dam are unknown.

h. Normal Operational Procedure. The reservoir is utilized for drinking water purposes by taking water through the upper gate house to two 48-inch supply lines. A 36-inch and a 10-inch pipe provide for blow off. To augment supply, water from the Aspetuck and Saugatuck River watersheds are diverted to Hemlock's Reservoir as needed.

1.3 PERTINENT DATA:

a. Drainage Area -	5.3 sq. miles
b. Discharge at Dam Site -	
Maximum Known Flood	Unknown
Warm Water Outlet	Not Applicable
Div. Tunnel Low Pool Outlet	Not Applicable
Diversion Tunnel Outlet	Not Applicable
Gated Spillway	Not Applicable
Ungated Spillway at Max. Pool	4,700 CFS
Total Spillway Cap. at Max. Pool	4,700 CFS

c. Elevation (above M.S.L.) -

Top of Dam	230
Max. Design Pool	Unknown
Full Flood Control Pool	Not Applicable
Recreation Pool	Not Applicable
Spillway Crest Ungated	225
Upstream Portal Invert Div. Tunnel	Not Applicable
Downstream Portal Invert. Div. Tunnel	Not Applicable
Streambed at Centerline of Dam	155
Maximum Tailwater	165±

d. Reservoir -

Length of Max. Pool	13,000 Ft.
Length of Recreation Pool	Not Available
Length of Flood Control Pool	Not Available

e. Storage -

Recreation Pool	Not Applicable
Flood Control Pool	Not Applicable
Design Surcharge	Unknown
Top of Dam	11,635 Acre-Feet

f. Reservoir Surface (acres) -

Top of Dam	Not Available
Max. Pool	Not Applicable
Flood Control Pool	Not Applicable
Recreation Pool	Not Applicable
Spillway Crest	437

g. Dam -

Type:	700' concrete gravity dam, 400' earth embankment
Length:	1,100 feet
Height:	75 feet
Top Width:	11 feet
Side Slopes:	Concrete Upstream: Vertical Downstream: 0.7 Horizontal/1 Vertical
Zoning:	Earth embankment, downstream slope: 2 Horizontal/1 Vertical
Impervious Core:	Concrete Core
Grout Curtain:	Unknown

h. Diversion and Regulating Tunnel -

Type:	No tunnel
Length:	Not Applicable
Diameter:	Not Applicable
Access:	Not Applicable
Regulation:	Not Applicable

i. Spillway -

Type:	Ogee
Length of Weir:	116 feet
Crest Elevation:	225
Gates:	Ungated
Upstream Channel:	Reservoir perimeter, stone bottom
Downstream Channel:	Concrete training wall

Spillway is founded on rock

j. Regulating Outlets -

Intake Structure:
- 8 - sluice gates, 3' x 5'-6"
- 2 - 48" dia. water supply mains
- 1 - 36" dia. reservoir drain - blow off
- 1 - 10" dia. gate house drain - blow off

SECTION 2 - ENGINEERING DATA

2.1 DESIGN:

The designer of the dam is unknown. Two drawings were utilized during this study entitled as follows:

a. "Hemlock's Dam Gate Houses" - not dated

b. "Gate House Details" - not dated

2.2 CONSTRUCTION:

A rock and earth profile developed for the site of Hemlock's Dam has been reviewed. The data and accuracy of the profile are unknown.

2.3 OPERATION:

No operation records were made available for use during this investigation.

2.4 EVALUATION:

a. Availability. Only plans showing some of the dimensional features are available. Specifications indicating the properties of the materials used and construction procedures are not available.

b. Adequacy. Information available is adequate for Phase I purposes.

c. Validity. There is no reason to question the validity of the documents reviewed.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS:

a. General. The dam is composed of two sections, a concrete core wall earth embankment on the west and a concrete dam with downstream earth berms on the east. The concrete section was gunited in 1964 and is spalling at several locations. Some staining is occurring, however, the source of water is unknown. The earth embankment sections were well maintained and did not show any evidence of sloughing, erosion, or wet spots.

b. Dam.

1) Gravity Concrete Section -

a) Upstream Face - For the full length of the dam horizontally about two feet above the water line there is an area of scour exposing the fine aggregate in the concrete. At almost every joint in the dam there is a larger space where deterioration has taken place and concrete is absent. Generally, there are some minor areas of spalling along the U/S face of the dam, however, at the panel adjacent to the gate house (west side) there is an area of severe spalling nearly the full length of the panel about one foot thick (approximately one foot above the water line). In the panel on the east side of the gate house there is an area of deep scour (one foot thick) for nearly its full length. Generally, there is some spalling of the joints at the coping.

b) Downstream Face - The joints are generally in poor condition. At the joint at Station 4+71 just above the ground surface a large area of gunite has spalled off exposing the wire mesh. At the joint at Station 5+31 there is a bubble for about the middle third of the exposed portion of the joint and a deep, narrow spalling of the gunite at the bottom third of the joint. There is efflorescence for most of the joint at Station 5+91 and a large wet spot near the ground surface. The joint at Station 6+51 has spalling and considerable rust stains. The panel between Station 6+51 and Station 7+11 has several areas of surface cracks, efflorescence and bubbles. Near the bottom of the joint at Station 7+11 there is an area of spalling several inches deep which exposes the wire mesh. A short distance down from the top of the dam horizontally across this joint there is a large bevel and just below a depression, probably due to guniting. In the panel between Station 7+11 and Station 7+71, near the bottom there is a large area of surface spalling. Also, in this panel near the bottom is a large bubble and some spalling and below this, an area of surface

cracks. Near the joint at Station 7+71 close to the ground surface is an area of deep spalling and efflorescence. In the panel at the gate house between Station 7+71 and Station 8+01 there is a large spalled area close to the top of the dam. At Station 8+01 the joint shows cracking for nearly the full depth and a bubble and small spalled area near the ground surface. Slight seepage was noted at several joints.

c) Spillway - The area of the spillway adjacent to the dam has severe spalling and the wire mesh is exposed at what appears to be the uppermost horizontal construction joint with water seeping through and evidence of efflorescence. There are several areas of cracking and spalling and also several places showing evidence of water seeping through at the horizontal joints.

d) Earth Embankment - The downstream berm is generally in good condition with no sloughing or wet spots noted. The berm appeared to be relatively shallow in the vicinity of the downstream concrete gate house.

Mica schist bedrock is exposed about 30 feet downstream from the face of the dam in the vicinity of Station 6+00. Several large outcrops appear to strike N35°W and dip 10° west. Additional stone inlets were located in the downstream berm at Station 4+90 adjacent to the access road, Station 5+25 on the berm and one near Station 9+70 on the left side of the dam. The outlet for the later stone inlet could not be located during the visual inspection.

2) Core Wall Embankment Dam Section -

a) Upstream Slope - The upstream slope was exposed for a distance of approximately 6 feet. (The reservoir was about 1 foot below the spillway crest.) The riprap extended to within 1 foot of the embankment crest and generally appeared in good condition. Some small windows were exposed through the riprap and there was some evidence of differential weathering of the mica schist riprap at a few locations.

b) Crest - The crest of the dam consisted of the top of the earth embankment, 30 feet wide. The core wall, 10 feet wide, is exposed only at the junction with the concrete dam, Station 3+89. A small test pit was excavated at Station 2+30 which uncovered the top of the concrete core wall about 9 inches below the roadway surface.

c) Downstream Slope - The portion of the downstream slope above the lower access road is grassed and had been recently mowed. It did not show any evidence of sloughing, erosion or wet spots. There are several stone inlets (stone was not removed) on the upstream side of the lower access road at

approximately Stations 1+37, 2+57, and 3+44. The inlets appear to connect to culverts which are laid underneath the access road and which connect into a grassed drainage channel on the downstream side of the road. All the culverts were dry except for a small trickle of water flowing from the culvert under the road at Station 1+37. Below the road, the slope is heavily wooded, and it is difficult to observe any movement.

There are a few holes made by burrowing animals on the slope.

c. Appurtenant Structures.

1) Upper Gate House - The upper gate house was clean and neat. The gate controls appeared to be easy turning and are exercised once a year. A recent diver's report is purported to have indicated that two of the stem guides were broken. (Report not released by Bridgeport Hydraulics Company.) A request by the inspection team to operate the blow offs to ensure proper functioning was not met. The filtration screens for the water supply mains have electrical power hoists in good condition. Electrical equipment for the hoists, interior light, dam floodlights, and deicer pumps appeared in good condition. All interior wiring was enclosed in conduits free of corrosion and dirt.

2) Lower Gate House - Generally good condition.

d. Reservoir Area. The reservoir perimeter has well vegetated banks at moderate to steep slopes. There was no evidence of slides or sloughing. No noticeable debris or obstructions were seen in the vicinity of the upper gate house. The depth of sediment, and rate of accumulation in the reservoir, is unknown. However, sediment has accumulated in the eastern end of the reservoir at the spillway (reaching the crest).

e. Downstream Channel.

1) Spillway Discharge - The spillway channel is in good condition. The low concrete and stone wall on the right side of the channel is also in good condition. Mica schist bedrock is exposed about 150 feet downstream from the spillway weir. At this location, it is planar, and strikes N10^{o}W and dips 10^{o} west. There are minor obstructions on the bottom of the channel consisting of small bushes, tree branches and grass growing at various locations along the bottom. The spillway channel has a large crevice near the end of the low concrete wall which has been created by differential erosion along the foliation of the exposed mica schist.

2) Blow-Off Discharge Channel - The channel is becoming obstructed with sediment at its junction with the spillway discharge channel.

3.2 EVALUATION:

The dam appears in good condition, and there are no visual indications of the dam being unsafe. The gunite repair (1964) has deteriorated and a program of concrete maintenance is warranted.

The spillway channel contained debris and obstructions on the bottom and it is important it be maintained to allow unobstructed flow during peak discharge periods. Some trees immediately adjacent to the left side of the spillway channel could also adversely effect capacity.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES:

Water is withdrawn through the upper gatehouse service gates and treated at a plant just downstream of the dam. Two 48-inch supply lines service customers in the greater Bridgeport region.

4.2 MAINTENANCE OF DAM:

The dam and associated structures are generally well maintained with a regular program of grass mowing and general maintenance in effect. Yearly routine inspections are carried out by Bridgeport Hydraulic Company staff. A consultant was hired to perform a cursory inspection of Bridgeport Hydraulic Company dams during November 1976. It was recommended that spalling concrete at Hemlock's dam be repaired.

4.3 MAINTENANCE OF OPERATING FACILITIES:

The operating valves were inspected recently; although the results of the inspection are not available, generally the valves/valve stems need some repair.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT:

There was no warning system of any kind in effect at the time of the inspection.

4.5 EVALUATIONS:

The Hemlock's Reservoir, which is approximately 70 years old, is well operated and maintained. Although not designed for rapid drawdown, it should be noted that, if the need should arise, drawdown could be effected by the following procedures:

a. Allowing for maximum discharge through the 36-inch and 10-inch blow-offs.

b. Allowing for discharge through the two 48-inch supply mains.

The blow-off was not operated during the site inspection, therefore comments on the serviceability cannot be made. The valve should be tested on a periodic basis to insure that it could be operated if required.

SECTION 5 - HYDRAULICS/HYDROLOGY

5.1 EVALUATION OF FEATURES:

a. Design Data. There is no available information on the hydraulic design criteria for this dam and appurtenances. Under established criteria (OCE Guidelines) the recommended spillway test flood for the size (intermediate) and hazard potential (high) classification is the probable maximum flood (PMF). The PMF is the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

An estimate of the magnitude of the test flood at the site is based on an analysis of several sets of regional flood frequency data as presented in Appendix II.

As a conservative approach to the investigation, the most critical design hydrograph was used throughout (peak discharge of 9,600 CFS).

A stage-discharge relationship was calculated for the spillway and indicates the following flows, based upon a coefficient of 3.6 and a length of 116 feet.

Stage - Discharge Relationship

Stage	Head, Ft.	Discharge Rate, CFS
225	0	0
226	1	420
227	2	1,180
228	3	2,170
229	4	3,340
230	5	4,670

The maximum spillway capacity, with no freeboard, is less than the peak inflow rate of the test flood. (Compare 9,600 CFS with 4,670 CFS.) In order to determine the effect of the reservoir storage capacity, a hydrograph of the test flood was routed through the reservoir.

The hydrograph was formed by assuming the test flood had a duration of 24 hours, with the peak of 9,600 CFS occurring at 8 hours from the beginning of runoff. The rising and falling limbs of the hydrograph were assumed to be changing at a constant rate, forming a triangle. The routing operation indicated that the peak rate of discharge would be reduced to 8,800 CFS, resulting in a stage elevation of 230.9 feet.

b. Experience Data. Discussion with water company personnel indicates that since the early 1950's the dam has not been overtopped.

c. Visual Observations. The on-site inspection of the dam provided the data for the hydraulic evaluation of the spillway.

d. Overtopping Potential. The peak rate of discharge from the test flood will overtop the dam and embankment (0.9 feet). The maximum spillway capacity is however equal to more than one-half of the test flood.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATIONS OF STRUCTURAL STABILITY:

a. Visual Observations. No evidence was observed that would indicate structural instability. The concrete surface (gunite) has deteriorated, and some water was seeping at the joints. Monitoring of this seepage should be initiated.

b. Design and Construction Data. The design and construction data available are not sufficient to formally evaluate the stability of the dam. In particular, there is no available information concerning the embankment and berm materials and construction documentation nor the foundation material for the core wall and the concrete gravity section. The drawing suggests that the gravity section was placed in an excavation. It is now known whether bedrock was reached and, if so, what was the in-situ properties of the bedrock.

c. Operating Records. There are no available records which indicate evidence of stability problems since the dam was constructed in 1914. As the Hemlock Reservoir Dam was designed and constructed as a water supply dam and has been subjected to a full head of water a majority of the time since construction, its stability could be considered to be adequate based on past performance.

d. Post-Construction Changes. A lime feed and storage tank was constructed downstream of the dam west of the treatment facility. A large diameter gas main was also constructed downstream of the dam south of the entrance roadway. Neither of these changes affects the structural stability of the dam.

e. Seismic Stability. This dam is in Seismic Zone 1 and hence does not have to be evaluated for seismic stability.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT:

a. Condition. Based on the visual inspection, records available and past operational performance, the dam is judged to be in good condition.

The project will not discharge the test flood without overtopping the dam, and therefore the spillway capacity is inadequate. The spillway capacity is not judged seriously inadequate, as the project will pass one-half the test flood without overtopping the dam.

b. Adequacy of Information. The information and data available were adequate for performance of this investigation.

c. Urgency. The recommendations and remedial measures presented should be carried out in the near term.

d. Need for Additional Investigation. Additional investigations to further assess the adequacy of the dam and appurtenant structures do not appear necessary.

7.2 RECOMMENDATIONS:

It is recommended that the following measures be undertaken by the owner:

1) Horizontal and vertical cracks should be patched to every extent possible to prevent seepage and continuing deterioration.

2) Since degree and extent of spalling is considered excessive, the areas affected should be repaired.

3) Sediment accumulation in front of spillway section (east side) should be removed and hauled away.

4) Defective valves and stems should be repaired to insure that if required, they could be operated to lower the water level in the reservoir.

7.3 REMEDIAL MEASURES:

Although the dam is generally maintained in good condition, it is considered important the the following items be accomplished:

a. Alternatives. Not applicable.

b. Operation and Maintenance and Procedures.

1) An operation and maintenance manual for the project should be prepared.

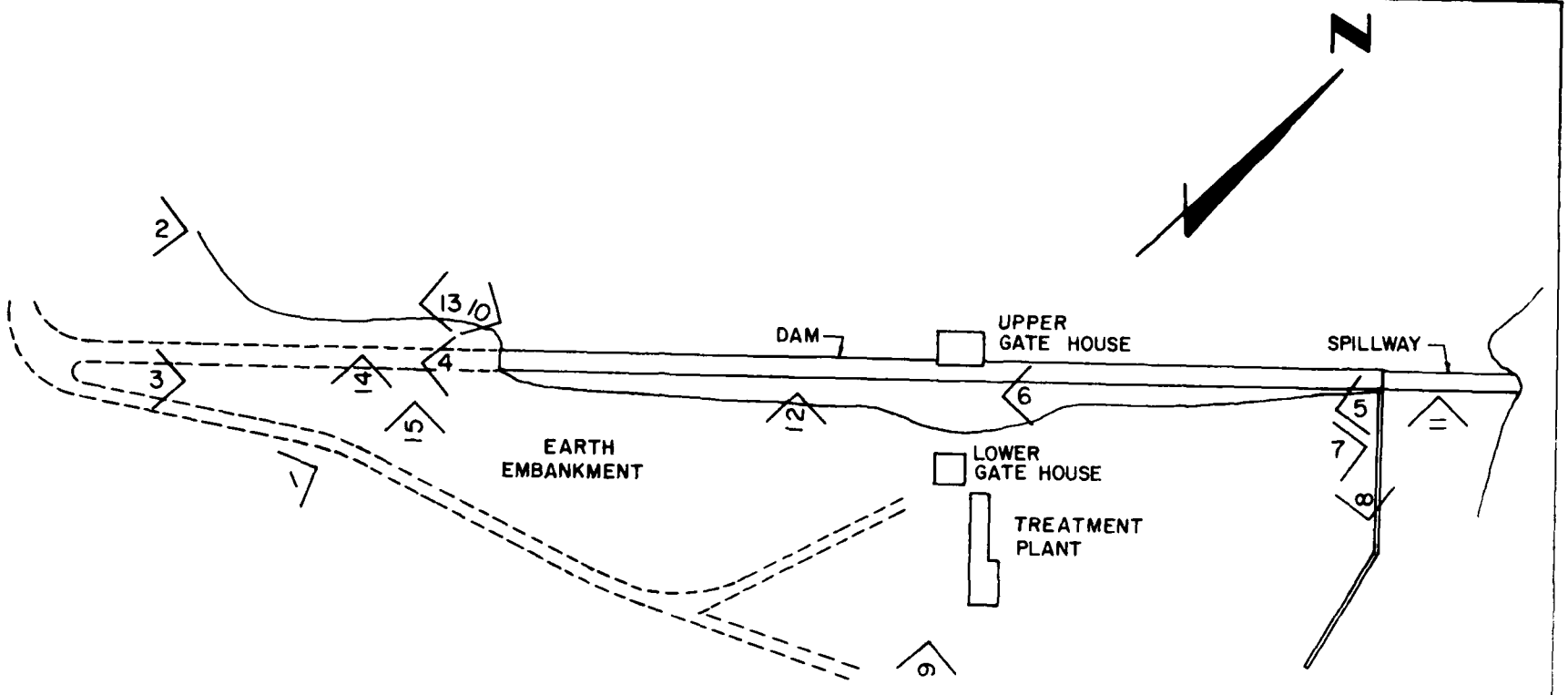
2) Animal bore holes should be filled and plugged.

3) The blow-off valve should be exercised periodically.

4) Due to the potential for overtopping, it is recommended that a definite plan for around the clock surveillance be implemented during periods of unusually heavy rains and a formal warning system be developed for use in the event of an emergency.

APPENDIX I

PHOTOGRAPHS



HEMLOCK RESERVOIR DAM

LOCATION OF PHOTOGRAPHS

PHOTO #1: Upstream Face of Dam, looking West.

PHOTO #2: Upstream Face of Dam and Spillway Bridge, looking East.

PHOTO #3: Spillway, looking East.

PHOTO #4: Spillway, looking West. Note Flashboards.

PHOTO #5: Outlet Works and Discharge Point and Channel.

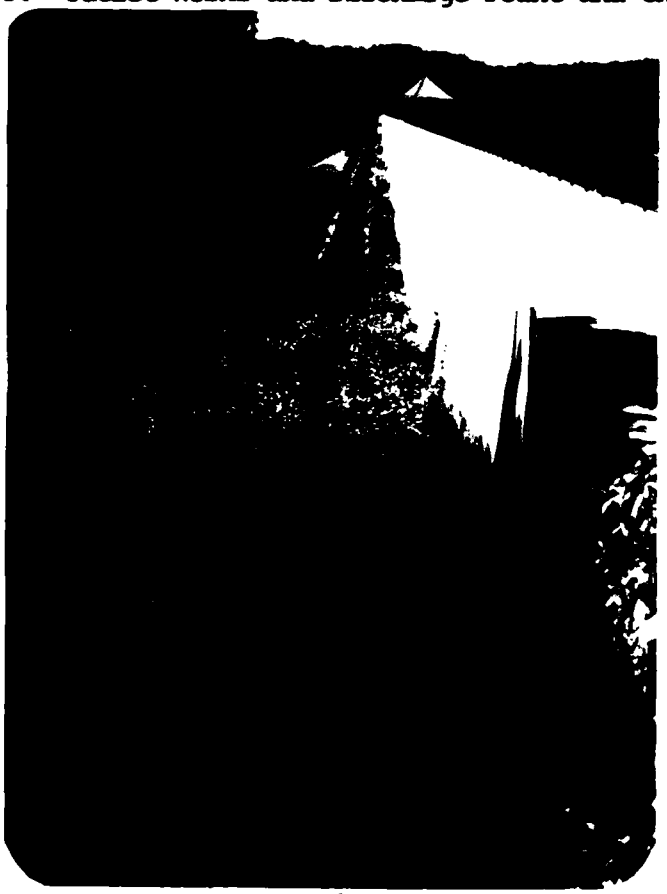


PHOTO #6: Downstream Face of Dam and Embankment looking West.

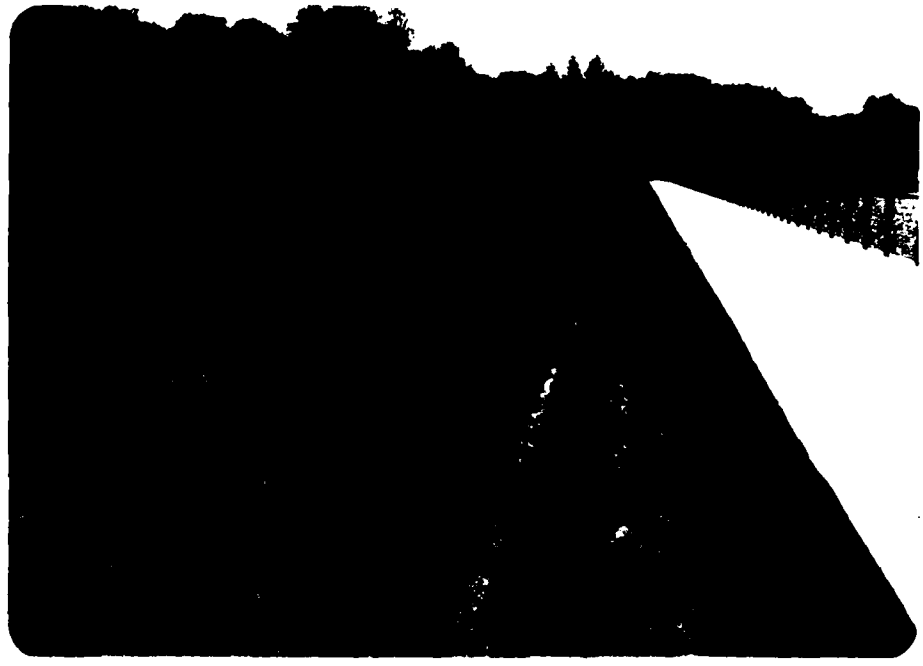


PHOTO #7: Downstream Face of Dam and Embankment looking West.

PHOTO #8: Central Portion of Embankment, looking East.

PHOTO #9: Control Tower.

PHOTO #10: Typical Spalling at a Construction Joint on the Upstream Face of the Dam.

PHOTO #11: Typical Spalling at Joint, Downstream Face.

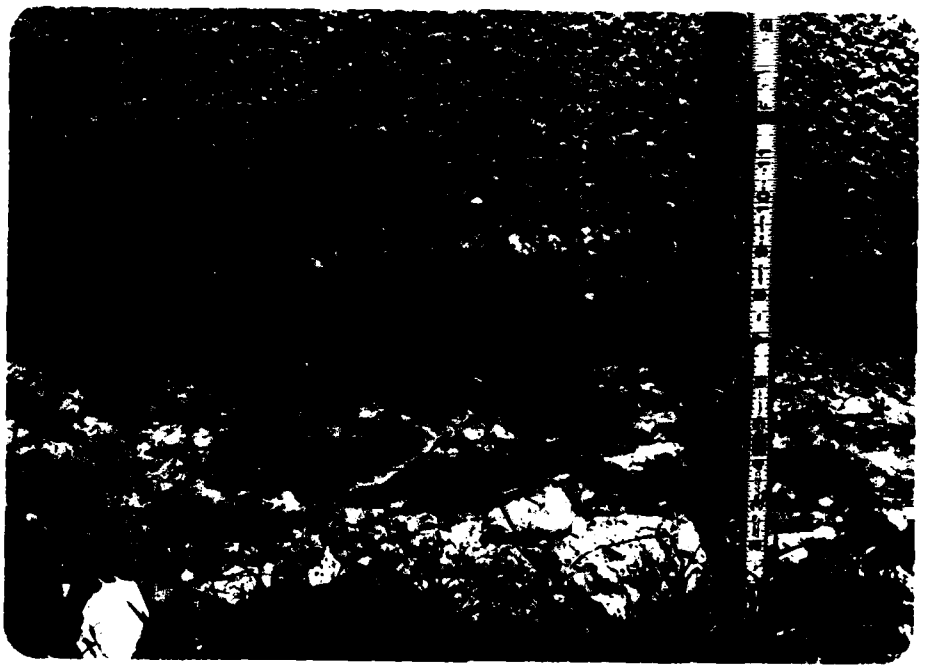
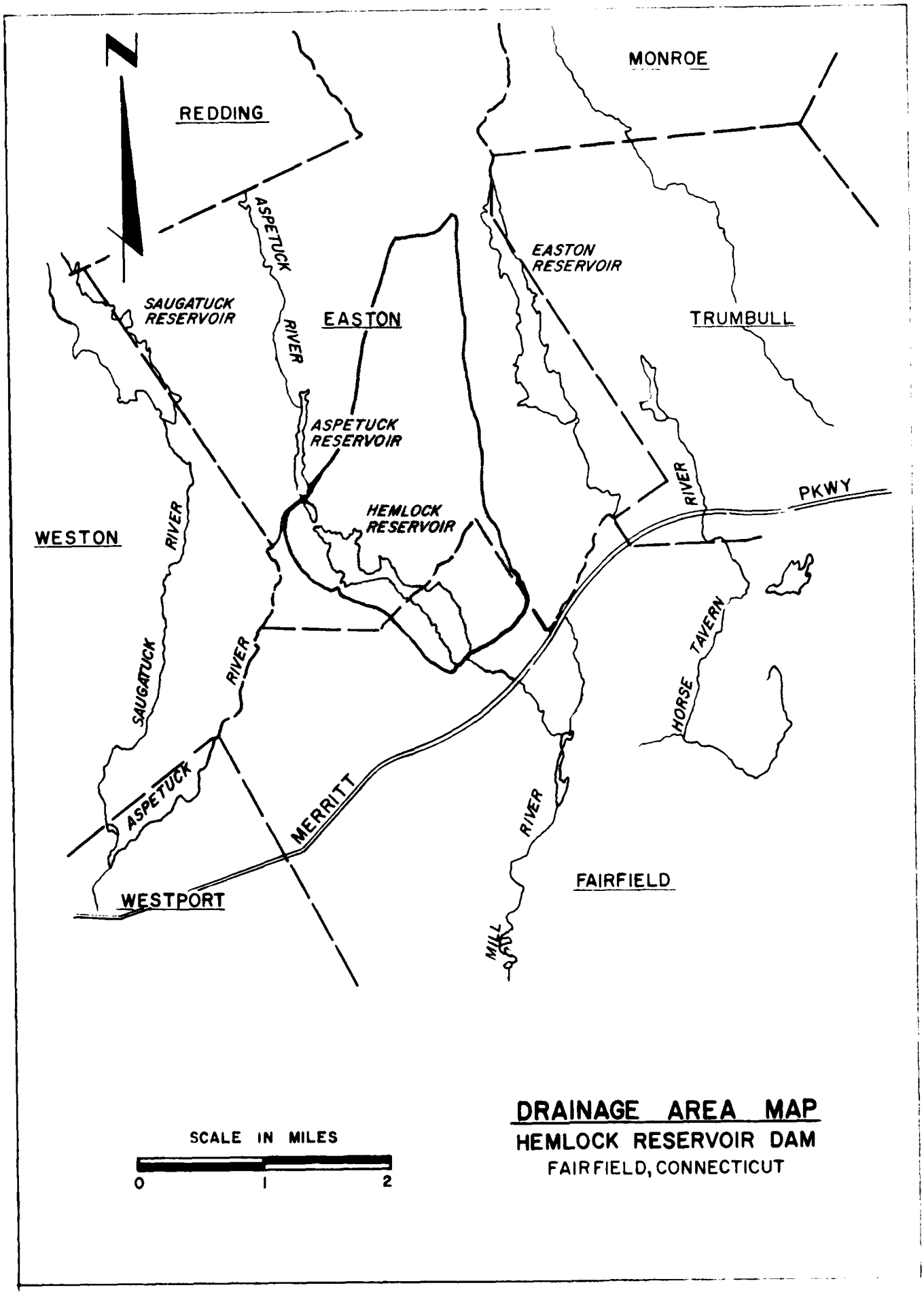


PHOTO #12: Typical Spalling, Downstream Face, at Top of Earth Embankment.

APPENDIX II

HYDROLOGIC COMPUTATIONS



SCALE IN MILES

0 1 2

DRAINAGE AREA MAP

HEMLOCK RESERVOIR DAM

FAIRFIELD, CONNECTICUT

HEMLOCK'S RESERVOIR DAM

FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN 06510/203/789-1260

SHEET NO. 1 OF 2
BY SGM DATE 7/5/78
CHK'D. BY RCS DATE 8/11/78

PMF PEAK FLOW ESTIMATE

WATERSHED AREA IS 5.27 SQUARE MILES

METHOD #1

REFER TO "PRELIMINARY GUIDANCE FOR ESTIMATING PMF DISCHARGES" by NEW ENGLAND DIVISION, CORPS OF ENGINEERS

UNIT FLOW = 1820 CFS/mi^2 (ROLLING)
PMF $\approx$ (5.27 mi^2)(1820 CFS/mi^2) = 9591 CFS
SAY $\approx$ 9600 CFS

METHOD #2

REFER TO CONN WATER RESOURCE BULLETIN #17, BY USGS, PART 4.

MEAN ANNUAL FLOOD = 250 CFS (FIG. 13)
Q_{100} = 5 x MAF = 5 x (250) = 1250 CFS (FIG. 14

PMF $\approx$ 5 x Q_{100} (APPROXIMATE)
PMF $\approx$ 5 x 1250 CFS = 6250 CFS

METHOD #3

REFER TO FAIRFIELD FLOOD INSURANCE STUDY, "FREQUENCY DISCHARGE, DRAINAGE AREA CURVES"

Q_{100} = 1500 CFS
PMF $\approx$ 5 x (1500) = 7500 CFS

FOR SPILLWAY EVALUATION, USE 9600 CFS

HEMLOCKS
RESERVOIR
DAM

FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN 06510/203/789-1260

SHEET NO. 4 OF 4
BY JGM DATE 7/5/78
CHK'D. BY RCS DATE 8/1/78

INFLOW HYDROGRAPH FORMATION

1) P.M.F. PEAK FLOW = 9600 CFS ±
2) FORM A 24 HOUR LONG TRIANGULAR INFLOW HYDROGRAPH, PEAK AT 8 HOURS

TIME HOURS	UNIT FLOW RATE	FLOW RATE CFS
0	0.00	0
2	0.25	2400
4	0.50	4800
6	0.75	7200
8	1.00	9600
10	0.875	8400
12	0.75	7200
16	0.50	4800
20	0.25	2400
24	0.00	0

3MLOCK DAM 78-36-10 FLOOD ROUTING JGM 7/14/78

NPUT DATA: UNSUBMERGED WEIR
EGMENT 1 DISCHARGE COEFFICIENT = 3.6 LENGTH OF WEIR = 116 ELEVATION OF WEIR = 225
EGMENT 2 DISCHARGE COEFFICIENT = 3 LENGTH OF WEIR = 1100 ELEVATION OF WEIR = 230
IE=225 IV= 0.0 E=225 A=437.00 E=235 A=437.00

HOUR	INFLOW	MASS INFLOW	WATER EL.	TAIL WATER	OUTFLOW	MASS OUTFLOW	STORAGE(R)	STORAGE(A)
0.00	0CFS	0.00AC-F	225.00FT	0.00FT	0CFS	0.00AC-F	0.00AC-F	0.00AC-F
2.00	2,400CFS	198.34AC-F	225.43FT	0.00FT	118CFS	9.78AC-F	188.56AC-F	188.56AC-F
4.00	4,800CFS	793.38AC-F	226.60FT	0.00FT	852CFS	90.03AC-F	703.35AC-F	703.35AC-F
6.00	7,200CFS	1,785.12AC-F	228.25FT	0.00FT	2,451CFS	363.09AC-F	1,422.02AC-F	1,422.02AC-F
8.00	9,600CFS	3,173.55AC-F	230.05FT	0.00FT	4,800CFS	962.45AC-F	2,211.09AC-F	2,211.09AC-F
10.00	8,400CFS	4,661.15AC-F	230.89FT	0.00FT	8,777CFS	2,084.61AC-F	2,576.53AC-F	2,576.53AC-F
12.00	7,200CFS	5,950.41AC-F	230.72FT	0.00FT	7,741CFS	3,449.80AC-F	2,500.60AC-F	2,500.60AC-F
16.00	4,800CFS	7,933.88AC-F	230.26FT	0.00FT	5,478CFS	5,634.92AC-F	2,298.96AC-F	2,298.96AC-F
20.00	2,400CFS	9,123.96AC-F	229.43FT	0.00FT	3,901CFS	7,185.37AC-F	1,938.59AC-F	1,938.59AC-F
24.00	0CFS	9,520.66AC-F	228.03FT	0.00FT	2,206CFS	8,194.99AC-F	1,325.66AC-F	1,325.66AC-F
30.00	0CFS	9,520.66AC-F	226.39FT	0.00FT	686CFS	8,912.16AC-F	608.49AC-F	608.49AC-F
36.00	0CFS	9,520.66AC-F	225.82FT	0.00FT	313CFS	9,159.93AC-F	360.72AC-F	360.72AC-F
48.00	0CFS	9,520.66AC-F	225.36FT	0.00FT	92CFS	9,360.97AC-F	159.68AC-F	159.68AC-F

APPENDIX III

VISUAL INSPECTION

CHECK LIST

PERIODIC INSPECTION CHECK LIST

PROJECT Hemlocks Reservoir DATE June 21, 1978

INSPECTOR Anthony Rummo DISCIPLINE Structural

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
CONCRETE DAM STRUCTURE	
General Condition Concrete Surfaces	Gunite surface severely spalled
Movement or Settlement of Crest	None
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and Other Structures	
Structural Cracking	None observed
Spalling	Major spalling of surface(gunite)
Visible Reinforcing	Wire mesh, exposed (gunite)
Rusting or Staining of Concrete	Yes, at some joints
Condition of Monolith/ Construction Joints	Joints in poor condition
Drains - Foundation, Joint, Faces	None
Any Seepage or Efflorescence	Major efflorescence observed and seepage noted at joints
Foundation Damage, Undermining	None
Water Passages	
Abutments	

PERIODIC INSPECTION CHECK LIST

PROJECT Hemlocks Reservoir **DATE** June 21, 1978

INSPECTOR Richard Murdock **DISCIPLINE** Geotechnical

INSPECTOR _____ **DISCIPLINE** _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	El. 225
Current Pool Elevation	El. 224
Maximum Impoundment to Date	
Surface Cracks	None observed
Pavement Condition	Ruts evident in roadway
Movement or Settlement of Crest	None observed
Lateral Movement	None
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Few small animal holes
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection - Riprap Failures	Good, some minor deterioration present
Unusual Movement or Cracking at or near Toes	None observed
Ususual Embankment or Downstream Seepage	None

PERIODIC INSPECTION CHECK LIST

PROJECT Hemlocks Reservoir **DATE** June 21, 1978

INSPECTOR Richard Murdock **DISCIPLINE** Geotechnical

INSPECTOR _____ **DISCIPLINE** _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT - (continued)	
Piping or Boils	None
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT Hemlocks Reservoir **DATE** June 21, 1978

INSPECTOR Anthony Rummo **DISCIPLINE** Structural

INSPECTOR James MacBroom **DISCIPLINE** Hydraulics/ Hydrology

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	Generally in good condition, some erosion
General Condition	
Condition of Joints	
Spalling	Minor spalling noted
Visible Reinforcing	No visable reinforcing
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	No cracks noted
Rusting or Corrosion of Steel	None
b. Mechanical and Electrical	
Air Vents	
Float Wells	Good condition
Crane Hoist	
Elevator	
Hydraulic System	None

PERIODIC INSPECTION CHECK LIST

PROJECT Hemlocks Reservoir DATE June 21, 1978

INSPECTOR Anthony Rummo DISCIPLINE Structural

INSPECTOR James MacBroom DISCIPLINE Hydraulics/ Hydrology

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER (continued)	
Service Gates	Good condition
Emergency Gates	
Lightning Protection System	Satisfactory
Emergency Power System	None
Wiring and Lighting System In Gate Chamber	Electrical, good condition

PERIODIC INSPECTION CHECK LIST

PROJECT Hemlocks Reservoir DATE June 21, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	Water travels from the reservoir directly into the intake structure.
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT Hemlocks Reservoir — DATE June 21, 1978

INSPECTOR Anthony Rummo — DISCIPLINE Structural

INSPECTOR Richard Murdock — DISCIPLINE Geotechnical

James MacBroom — Hydraulics/Hydrology

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Sediment has accumulated at eastern end of approach to spillway
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir and Training Walls	
General Condition of Concrete	Severe spalling
Rust or Staining	Yes
Spalling	Yes
Any Visible Reinforcing	Wire mesh exposed
Any Seepage or Efflorescence	Some seepage and efflorescence
Drain Holes	None observed
c. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	A few trees in close proximity to left wall.
Floor of Channel	Good condition
Other Obstructions	Brush, grass, a few wood pieces

PERIODIC INSPECTION CHECK LIST

PROJECT Hemlocks Reservoir DATE June 21, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	
a. Super Structure	None
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutments & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

PERIODIC INSPECTION CHECK LIST

PROJECT Hemlocks Reservoir DATE June 21, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT Hemlocks Reservoir DATE June 21, 1978

INSPECTOR James MacBroom DISCIPLINE Hydraulics/ Hydrology

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel	
Loose Rock or Trees Overhanging Channel	Generally good condition; some sediment collected at junction with spillway discharge channel
Condition or Discharge Channel	

APPENDIX IV

ENGINEERING DATA

CHECK LIST

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Hemlocks Reservoir Dam

I.D. NO. 18

ITEM	REMARKS
AS-BUILT DRAWINGS	None exist
REGIONAL VICINITY MAP	Available from U.S.G.S.
CONSTRUCTION HISTORY	Not available (letter in DEP File, re: cursory inspection)
TYPICAL SECTIONS OF DAM	From plans, Concrete Section only
OUTLETS - Plan	From plans, not complete
- Details	From plans, not complete
- Constraints	Unknown
- Discharge Ratings	None available
RAINFALL/RESERVOIR RECORDS	None
DESIGN REPORTS	None
GEOLOGY REPORTS	None
DESIGN COMPUTATIONS	
HYDROLOGY & HYDRAULICS	None
DAM STABILITY	None
SEEPAGE STUDIES	None
MATERIALS INVESTIGATIONS	
BORINGS RECORDS	None
LABORATORY	None
FIELD	None

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

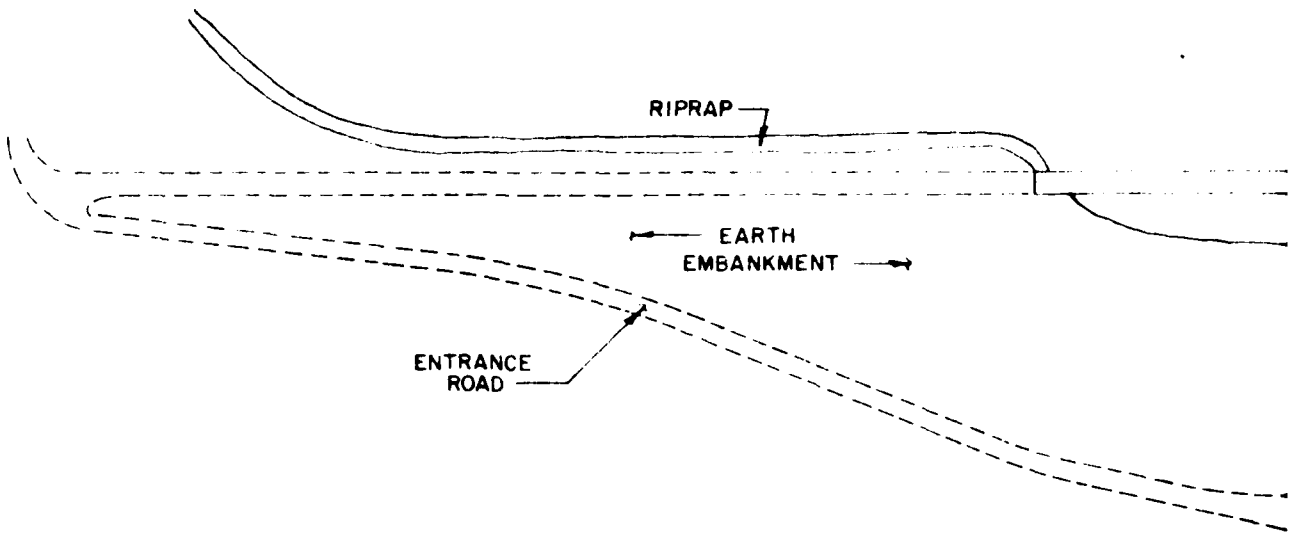
NAME OF DAM Hemlocks Reservoir Dam

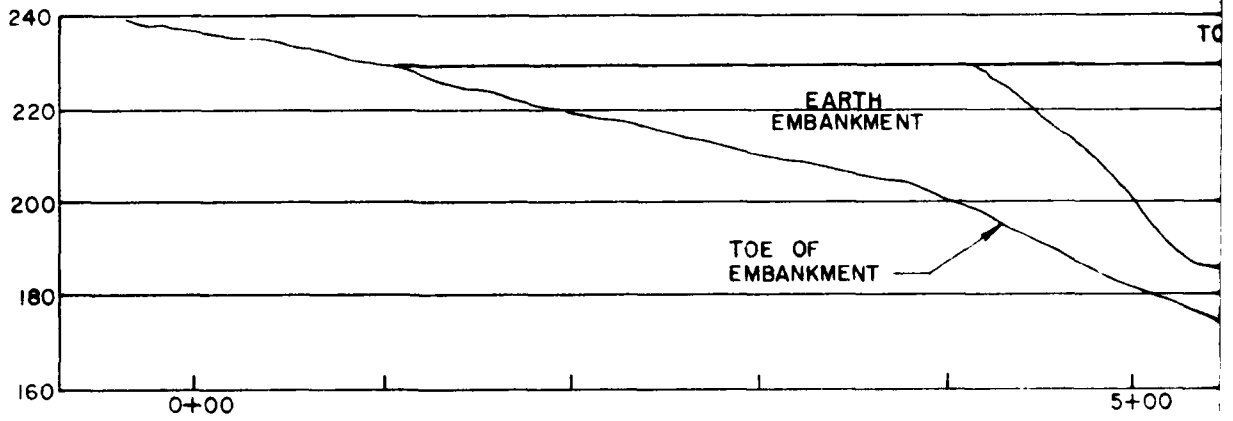
I.D. NO. 18

ITEM	REMARKS
POST-CONSTRUCTION SURVEYS OF DAM	None available
BORROW SOURCES	Unknown
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	Approximate from Bridgeport Hydraulic Co. records
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	Inspection reports from Bridgeport Hydraulic Co.
SPILLWAY PLAN	
SECTIONS	From plans
DETAILS	From plans
OPERATING EQUIPMENT PLANS & DETAILS	From plans

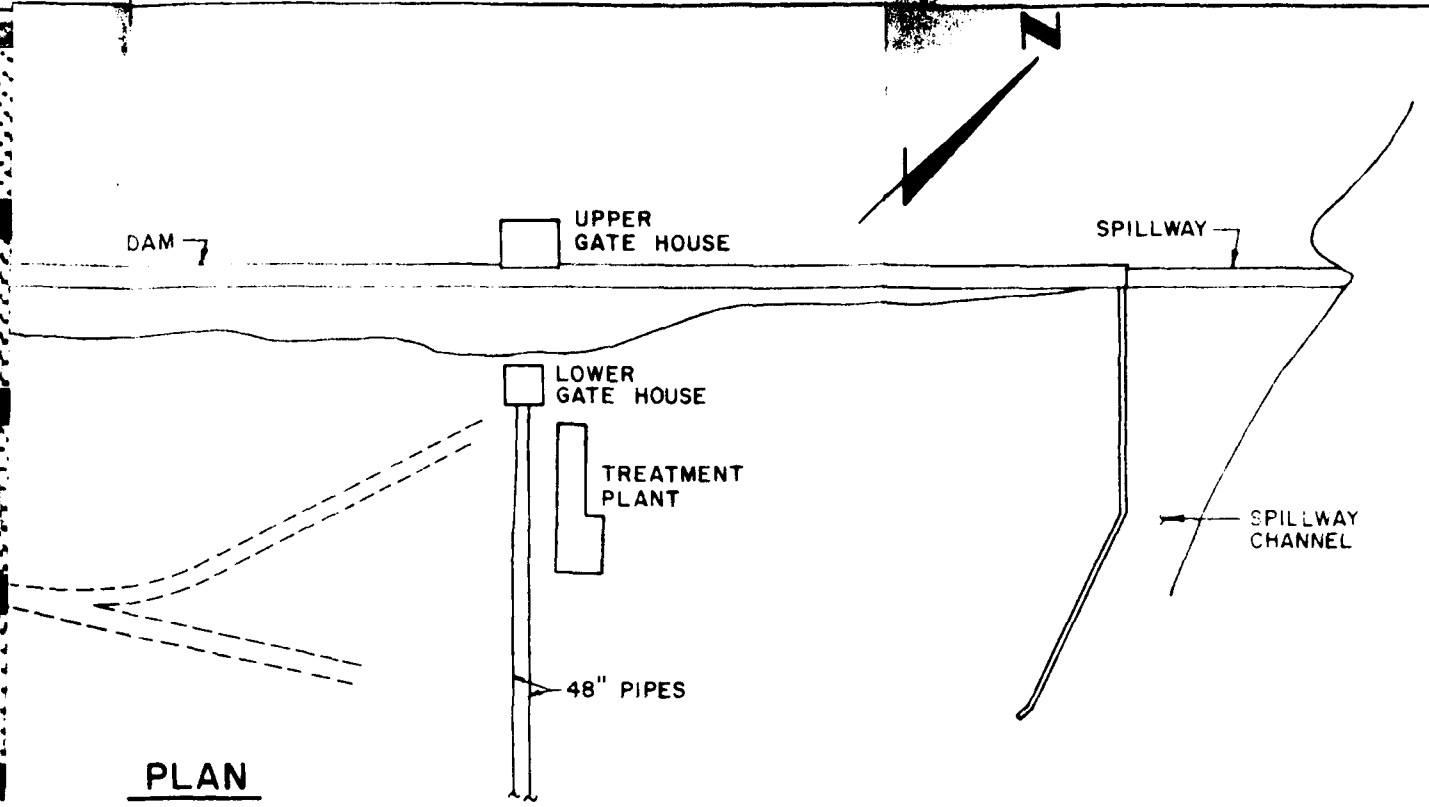
APPENDIX V

DRAWINGS

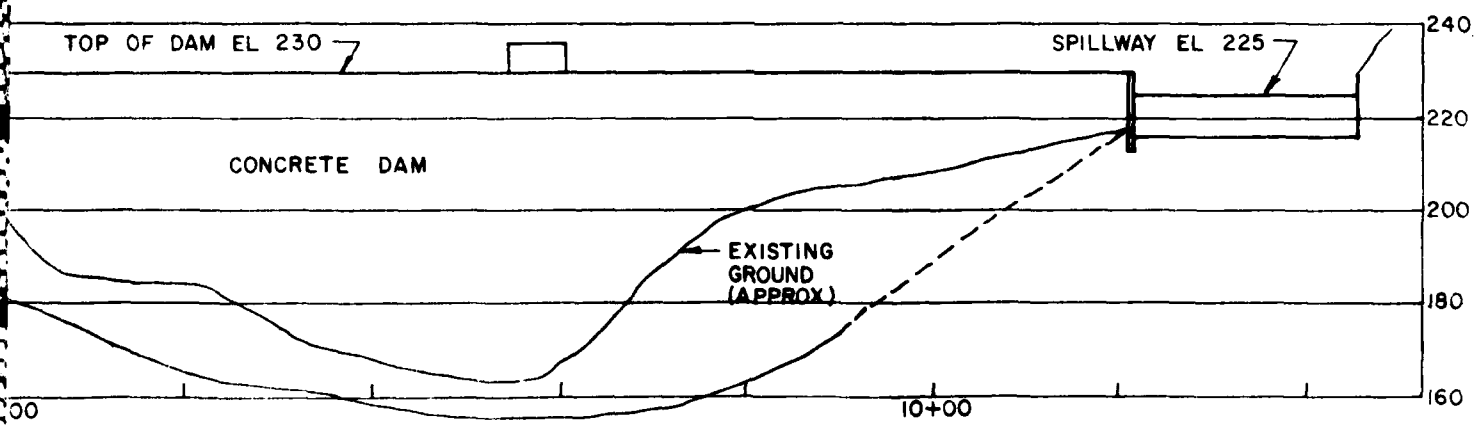

RIPRAP
EARTH
EMBANKMENT
ENTRANCE
ROAD


240
220
200
180
160
EARTH
EMBANKMENT
TOE OF
EMBANKMENT
0+00
5+00

DOWNSTREA

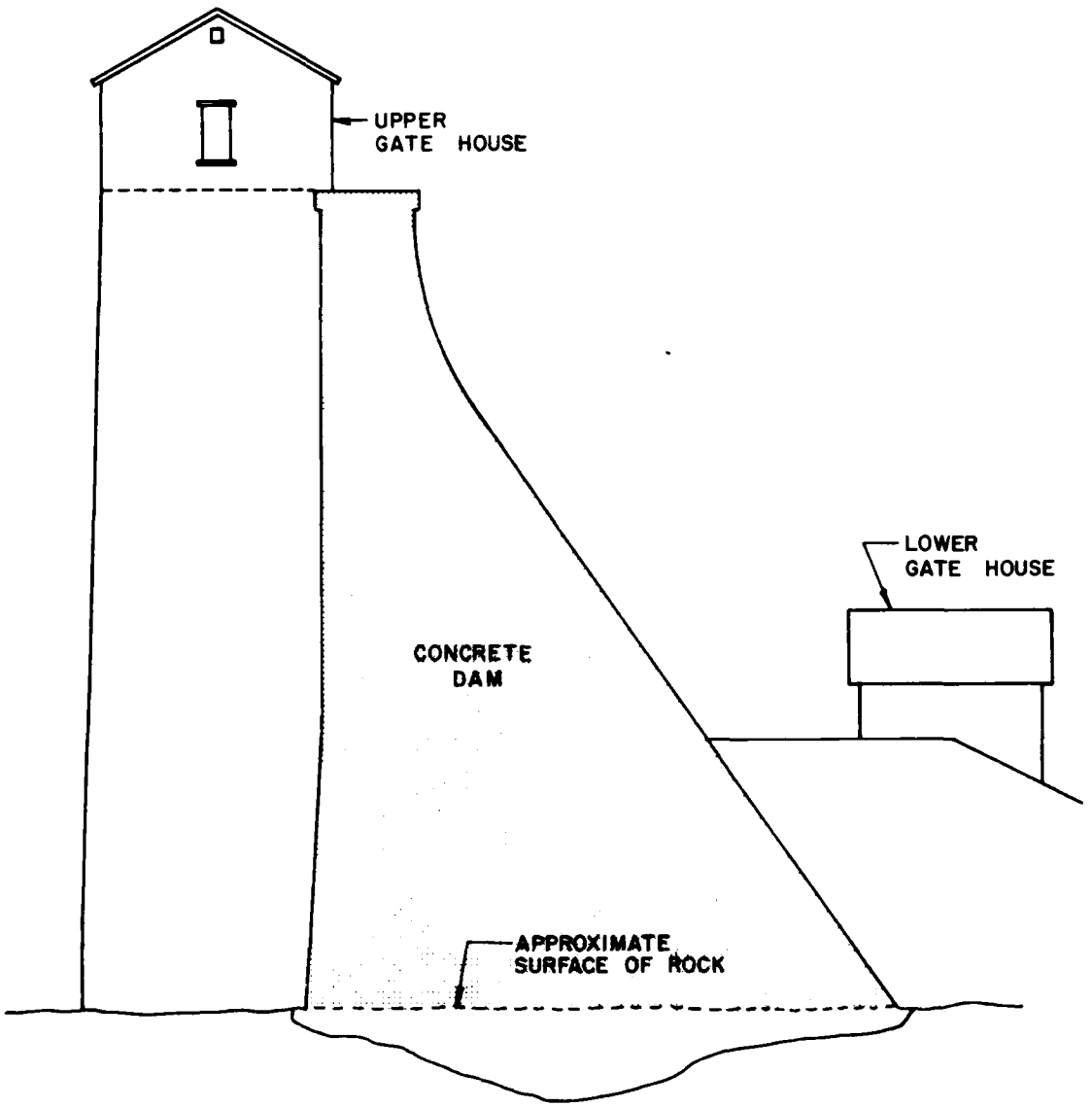


PLAN
NTS



REAM ELEVATION OF DAM
NTS

HEMLOCKS RESERVOIR DAM
MILL RIVER



SECTION OF DAM AND GATE HOUSES

NTS

HEMLOCKS RESERVOIR DAM

MILL RIVER

APPENDIX VI

INFORMATION AS CONTAINED IN

THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY | MO | YR
CT	16	NED	CT	001	04				HEMLOCK RESERVOIR DAM	4112.5	7316.9	18AUG78

POPULAR NAME	NAME OF IMPOUNDMENT
	HEMLOCK RESERVUIR

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	07	CRICKEN BROOK	FAIRFIELD	2	57100

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)
RECTPG	1914	S	75	70	11635	9000

DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
NED	N	N	N	N	18AUG78

REMARKS

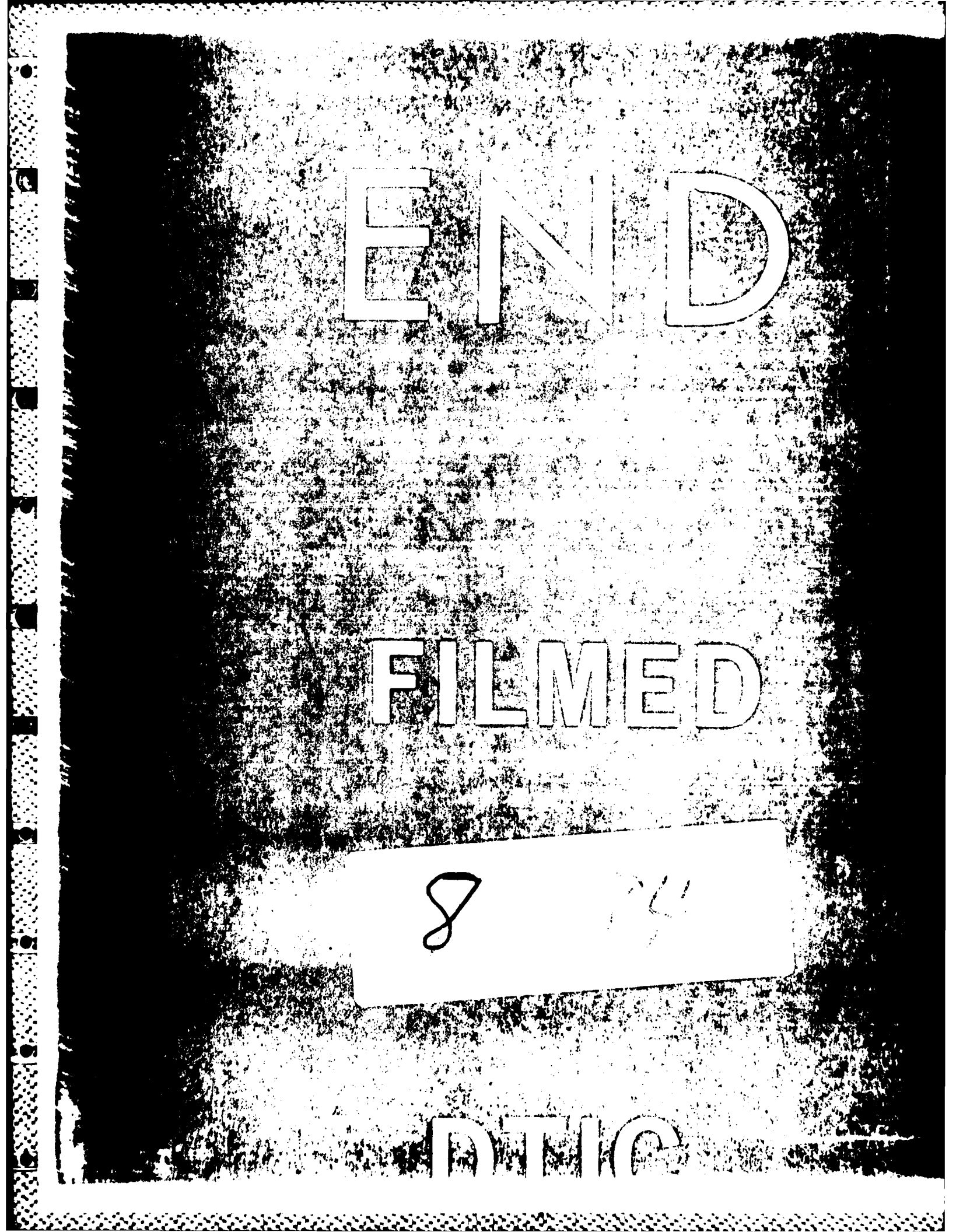
D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	1116	U	116	8670	162000											

OWNER	ENGINEERING BY	CONSTRUCTION BY
BRIDGEPORT HYDRAULIC CO		

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY | MO | YR	AUTHORITY FOR INSPECTION
FLAHERTY-GIAVARA, ASSOC, PC	21JUN78	PL 92 367

REMARKS	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8
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